BRS Acoustic Analysis, Southern California Behavioral Response Study SOCAL Range Complex Marine Mammal Monitoring Support

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LONG-TERM GOALS

The Behavioral Response Studies are intended to collect information which will enable the Navy to minimize negative impact on marine mammals related to sonar and other sources of anthropogenic sound in the marine environment from Navy training operations.

The Whale Identification, Logging and Display (WILD) software is intended to be a solution which provides the situational awareness needed to conduct controlled exposure experiments safely while thoroughly documenting the events and context in which they occur. It must also support typical marine mammal density survey operations. The long term goals for WILD system upgrades and modifications will be based on recommendations made from use on the MED 09 and SOCAL 10 sea trials.

WILD must be a flexible, easy to use software solution that records, integrates and displays visual and acoustic observations of marine mammals, research vessels, sonobuoy locations, and other contextual information relevant to the experiments and their analysis. WILD must also support typical survey, focal follow, and mitigation operations. WILD must have little or no software licensing costs to the user community.

OBJECTIVES

The objective of the WILD upgrades for SOCAL 10 included three tasks as follows:

Task 1: Upgrade WILD hardware for SOCAL 10. This objective was to upgrade to ruggedized computers, add an AIS receiver, and add a more robust heading sensor for the primary vessel.

Task 2: Upgrade WILD software configuration. The objective was to modify the Logger software module to reflect recommendations of the visual observers and lesssons-learned and recommendations from visual observers. The NMEA distributors also required upgrade modifications to incorporate the new sensor inputs.

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Task 3: Cruise plan input and at-sea support. The objective was to provide input on WILD use and configuration to the cruse plan. The objective was to also provide one WILD personnel for each of the two legs of the SOCAL 10 cruise.

APPROACH

The continuing development of WILD includes the use of industry standard programming languages and methedologies which result in compiled, easily installed, royalty free software. Planned upgrades and modifications to the WILD hardware and software were made based on lessons-learned from visual observers on the MED 09 cruise and communication with observers who would be working on SOCAL 10.

The key individuals included Chris Kyburg, Andy Patterson, and Rowena Carlson.

WORK COMPLETED

Hardware:

- Two ruggedized Panasonic Toughbook notebook computers were purchased to upgrade the versatility and reliability of the WILD system.

- Research was done to evaluate available heading sensors that would function on any vessel. The Vector G2 GPS heading compass was selected and was integrated in to the WILD system.

- The AMEC CYPHO-101G AIS/GPS receiver kit and VHF antenna were integrated in to the WILD system.

- WiFi was integrated between the GIS display systems to reduce cable requirements.

Software:

- The WILD Logger software module was upgraded based on lessons-learned and recommendations from visual observers. Binocular and observer information were added or modified as needed.

- The Vector G2 GPS heading compass output was integrated successfully in to the WILD software.

- The NMEA distributor software was modified to enable input from the AIS and GPS heading sensors. Data transfer was accomplished via UDP protocol using standard NMEA strings.

- Automatic archiving in the geodatabase was modified to receive data from the new sensors. The logger database structures and data types were also upgraded.

- ArcGIS software was upgraded to Version 9.3.

- The GIS Mapper module was modified to allow mapping of tag boat and other vessel locations received from their AIS transponders.

- Capability was added to the WILD Mapper module which allows users to add, remove and modify any number of vessels of interest and to select whether to track them by AIS or GPS.

At-sea support

Chris Kyburg provided at-sea support during the 20 day period of Leg I of the cruise aboard the dive boat Truth. Rowena Carlson provided support during the 10 day period of Leg II aboard the R/V Sproul. They installed the system on the respective vessels, provided training to the visual observers, provided GIS display support to the chief scientist for situational awareness during playback situations, and provided daily plots, data base files, and GIS files for the archive. Chris also assisted the chief scientist in planning the data archive format. Rowena also assisted as a visual observer and data logger.

RESULTS

WILD was successfully upgraded and deployed on SOCAL 10. The major new capabilities demonstrated during this cruise included integration of Automated Information System (AIS) for recording and display of the two tag boats and all other vessels in the area that were transmitting their positions on that system. WiFi was also integrated to reduce the need for a cable between the display system for the observers and the display system on the bridge. A picture of these units is shown in Figure 1. A GPS heading compass (Figure 2) was also integrated for greater accuracy in measuring the primary vessel heading and so providing greater accuracy in calcualtion of the observed animal positions.

Figure 1. AIS reciever, router, WiFi system, and ruggedized notebook computer are shown as they were installed on the bridge of the R/V Sproul during Leg II of SOCAL 10.

Figure 2. Vector G2 GPS heading compass is shown as it was installed on the R/V Sproul.

The real time data that was logged and displayed by WILD included:

- animal latitude and longitude and observed aspect
- all visual observations of animals and releveant information in either survey mode, focal follow mode or mitigation mode
- current heading and continuous ship track of the primary vessel
- current heading and continuous ship track of the two tag boats from their AIS transmission
- continuous ship tracks of vessels transmitting over AIS in the study area
- location of deployment and recovery positions of the acoustic source
- 200 meter and 1000 meter ZOI boundaries around the acoustic source location
- deployment location of all sonobuoys and XBTs
- deployment and recovery location of the towed acoustic array

Archival base maps were available for the GIS display as follows:

- Bathymetry data in raster and vector contour format
- NOAA raster nautical charts
- Marine sanctuary boundaries
- Bottom mounted San Clemente Island range hydrophones
- San Clemente Island range boundaries
- Relevant land mass boundaries
- Coastal cities and ports

All of the dynamic and static parameters were displayed concurrently at two locations on the primary vessels for each phase of the cruise. The Logger computer was made capable of toggling back and forth between the Logger window and the GIS display which made the system more easily used in confined work areas as shown in Figure 3 aboard the R/V Sproul. The GIS display was also available on the bridge through a WiFi connection a shown in Figure 1. The visual observers and chief scientist provided very positive feedback on all modifications that had been made to support SOCAL 10.
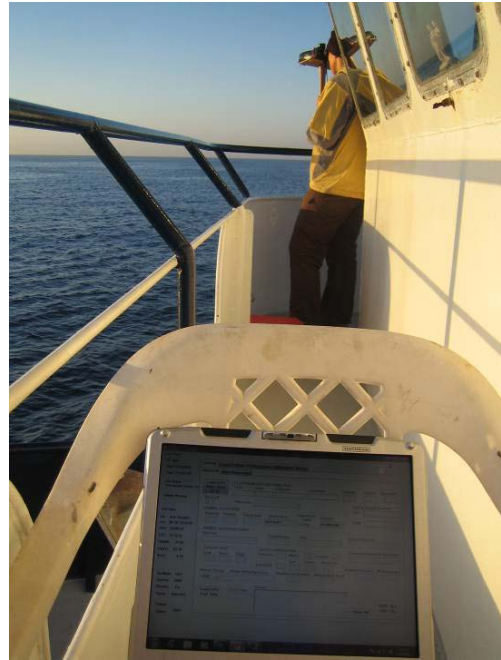

Figure 3. WILD Logger system and visual observer configuration are shown as used aboard the R/V Sproul during Leg II of SOCAL 10.

WILD was used successfully to record visual sightings as well as provide essential support for situational awareness before, during and after a playback as shown in the example in Figures 4a-c.
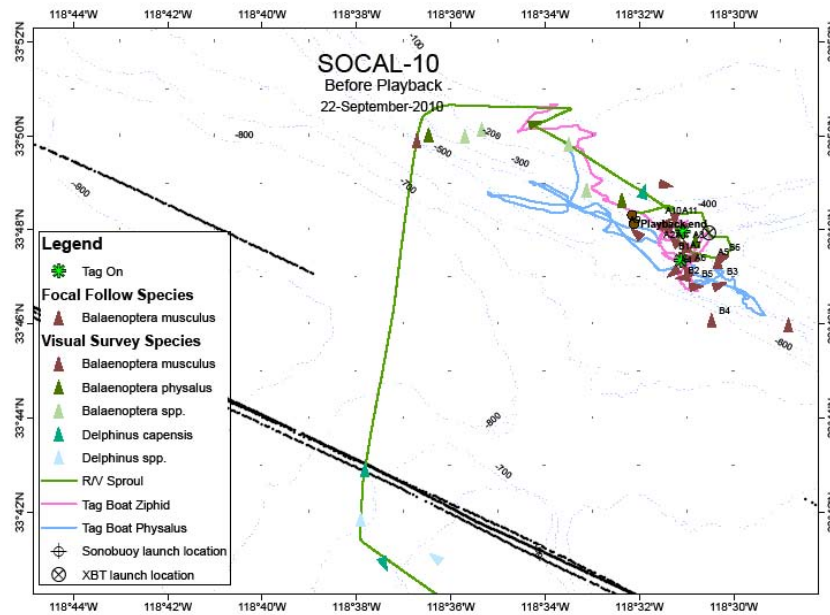
Figure 4a. WILD data showing the movement of tag boats, R/V Sproul and visual sightings of a tagged blue whale before a playback on 22 September 2010. Tracks of other ships in the area as received by the AIS system are shown by the black lines.
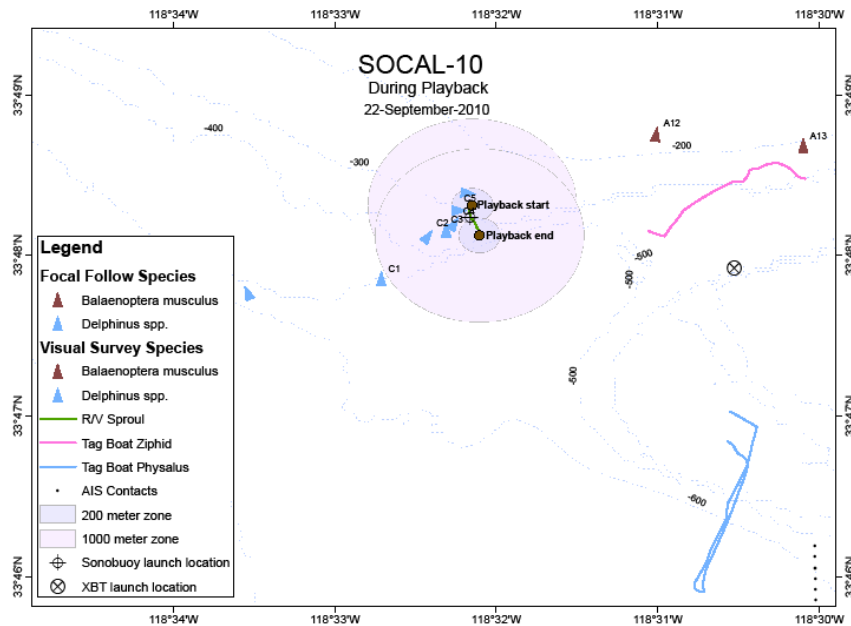

Figure 4b. WILD data showing the configuration of the tag boats, R/V Sproul, and visual sightings of animals during a playback done on a tagged blue whale on 22 September 2010. It can be seen here that the WILD GIS display was essential for displaying the zone of influence (ZOI) which was required to be monitored during playbacks.
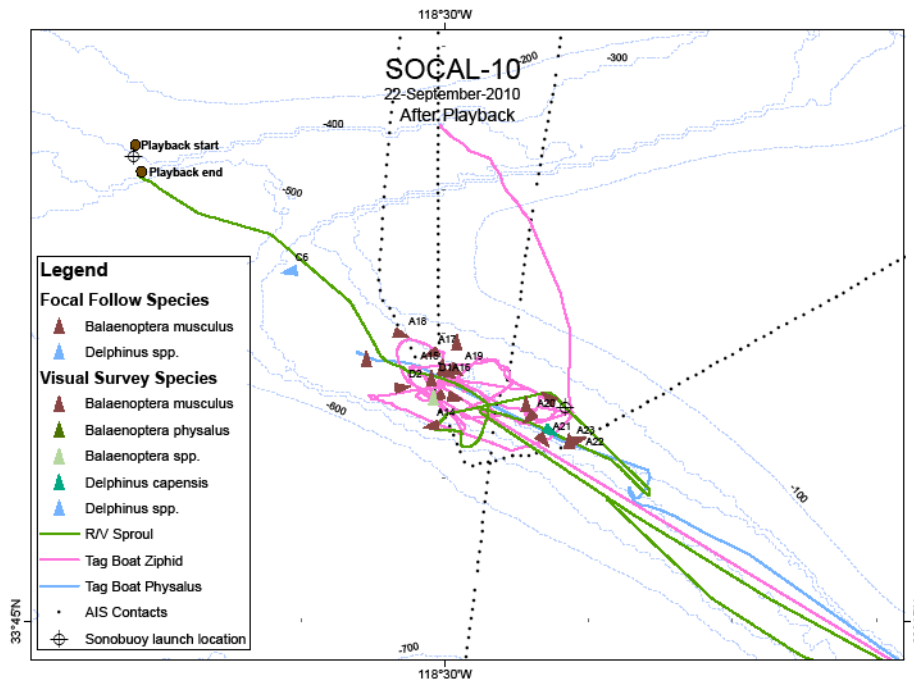
Figure 4c. WILD data showing the configuration of the tag boats, R/V Sproul and visual sightings of animals after a playback on a blue whale on 22 September 2010. Tracks of other ships in the area during that time period (as received by the AIS system) are shown by the black lines.

IMPACT/APPLICATIONS

The WILD system provided a layered and flexible approach to providing the situational awareness required for SOCAL 10 survey, tagging and playback operations. The GIS Mapper was used to assist in positioning the vessel deploying the acoustic source to enable a successful playback within the parameters of the cruise permits and protocols. The automated recording of all positional data during a playback provided documentation of permit compliance.

WILD also provides the capability for real time or post exercise analysis that integrates data obtained from all dynamic measurements. It has the proven capability to integrate a range of static and dynamic data. It has been shown that WILD is capable of being installed and used successfully on a variety of vessels. Due to the innovative development of the WILD NMEA distributor, a range of systems outputting spatial data can be integrated, recorded and the output displayed on the GIS Mapper.

The WILD system has also been used to support standard marine mammal survey operations. The WILD Logger module can be used alone for such surveys or used in combination with the GIS Mapper module fir display of the animal observations in real time.

Further development is required to continue to make the WILD system more robust and flexible and to incorporate the further recommendations of the visual observers who participated on SOCAL 10.

7

TRANSITIONS

WILD will be presented to the NOAA Science Advisory Board for possible use on NOAA marine mammal and turtle surveys. WILD has also been presented to the Atlantic Marine Assessment Program for Protected Species (AMAPPS) for possible use on that multi-year research program.

RELATED PROJECTS

None.

PATENTS

Two applications are being prepared for SSC Pacific Counsel.